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MELON AND CUCUMBER INSECTS

By C. J. Drake and F. A. Fenton

Probably the most important factor in the production of melon, cucumber, squash, pumpkin and other cucurbit plants in Iowa is the control of their insect enemies. Altho these plants are not liable to attack by many kinds of insect pests, they are frequently badly injured or even entirely destroyed by a few very destructive species. Some of these feed upon the foliage, others upon the flowers, while others bore into the stem or even into the roots. Much of the damage done by these pests may be prevented by applying the correct remedy at the proper time.

Fig. 1—Striped cucumber beetle.

Insects not only injured the plants *directly* by their feeding activities, but also *indirectly* because they may carry and inoculate healthy plant tissues, with serious disease producing organizations. The two most serious plant diseases carried by the melon aphid and striped beetle are bacterial wilt and mosaic disease.

THE MELON APHIS

(Aphis gossypii Glover)

The melon aphis is the most common and most destructive plant louse infesting cucumbers, cantaloupes, watermelons, gourds, squashes and pumpkins. It is particularly troublesome on the first three plants named. It may usually be distinguished from other aphids by its smaller size, being about one-twenty-fifth of an inch long. The color varies from yellow to green or black. Plant lice cause injury either by transmitting plant diseases or by killing or stunting the vines by sucking out the plant sap. They cluster thickly on the undersides of the leaves and the feeding punctures cause the leaves to curl and later to die.

The complete life cycle of this insect is not known. The lice first appear on the vines very early, often before the first true leaves develop. They have been observed on the unfolding seed leaves before these had completely pushed thru the surface crust of the soil. They do not usually breed up in sufficient numbers to cause trouble until after the vines have started to bloom and run. Then they appear to have suddenly

Fig. 2—The knapsack bellows type of hand duster.

Fig. 3—Cantaloupe injured by the melon aphid.

multiplied in great numbers whereas in reality they were slowly developing unnoticed for some time. It is characteristic in fields to have isolated hills here and there infested, after which the insects spread to the rest of the planting. Winged individuals develop freely on plants which are heavily infested and dying and hence their migration to other plants is certain.

Control: Constant watchfulness is the keynote of success in control. Examine the young plants closely and frequently during late May and June and give thoro treatments with the proper dust or spray as soon as the lice are discovered.

A solution of nicotine sulfate, one-half pint to 50 gallons of water, in which two pounds of finely sliced soap has been thoroly dissolved, is an excellent control. The under sides of the leaves should be completely drenched. An angle disc nozzle attached to an upturned three-foot spray rod is excellent for this purpose. If the hills are spaced properly, a wheel-barrow type of spray pump is satisfactory for small plantings. Larger acreage requires a power pump with two leads of hose and the trailer method of application.

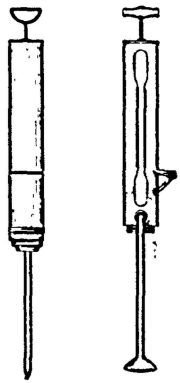

Fig. 4—Two types of small hand dusters.

If properly applied, the dust treatment is just as effective as spraying. Dusting machinery is cheaper in original cost, maintenance and operation, and with it many more plants can be treated in a given length of time. The plants should be dusted in the early morning or evening when there is very little wind stirring, altho occasionally atmospheric conditions are such that good results will follow treatment during midday. It is absolutely necessary that the dust cloud enshroud the plants for several seconds and not be blown rapidly away by the wind.

Fig. 5—Spout of hand duster showing cone attachment.

A nicotine dust containing three and three-quarters percent nicotine sulfate or one and one-half percent free nicotine is effective. Dusts containing a smaller percent are not so efficient. A good knapsack duster with a capacity of about ten pounds is satisfactory to treat a large acreage when the plants are small. (figs. 2 and 6). At this time a canvas cone attached to the end of the spout of a bellows duster and placed over the infested plants insures perfect fumigation. The bottom of the cone is held open by a heavy wire ring (fig. 5). For very large plantings a power duster with a canvas trailer is best. As the plants increase in size the amount of dust necessary for effective treatment and the total time required for dusting increases. The amount of nicotine dust needed per hill is less than the amount of gypsum mixture recommended for the control of the striped cucumber beetle.

SQUASH BUG

(Anasa tristis DeG)

The squash bug is a large, oblong insect, somewhat over one-half an inch in length and brownish black in color. The adults hibernate under boards, beneath leaves, bark and wherever else favorable shelter may be found. The eggs are deposited in irregular groups on the under sides of squash, gourd and pumpkin leaves in the angles formed by the larger veins. They are quite conspicuous and of a metallic yellowish brown color. The egg laying period lasts for about six weeks and in about two weeks after the first are deposited, the young nymphs make their appearance. After feeding for about four or five weeks the adult stage is reached. The young bugs are brightly colored but become darker as they grow older. They feed in large clusters on the under side of the leaves. Their work is first indicated by the wilting of the leaves here

Fig. 6—The crank-blower type of hand duster.

Fig. 7—Pumpkin field destroyed by squash bugs.

and there in the field. In case of severe infestation, the entire plant dies. They are very shy creatures and move to the opposite side of the stem or leaf when disturbed.

Control: Inspect the small squash plants carefully and destroy the eggs, nymphs and adults. Both the nymphs and adults have the habit of hiding themselves beneath clods, leaves or other shelter near the vines during the night. If shingles or small boards are placed near infested vines, the bugs will congregate under these and then they should be gathered early in the morning and destroyed before they scatter for feeding. Cleaning up the vines in early fall is important in reducing the hibernating numbers.

THE SQUASH VINE BORER

(Melittia satyriniformis Hbn.)

The squash vine borer is one of the most serious pests affecting squash and pumpkin vines. It also attacks gourd, melon, cantaloupe and cucumber plants but not commonly. Hubbard and crook-neck squashes are especially preferred varieties. The injury is caused by the caterpillars boring in the main stems of the vines, especially near the base. The plants are often practically girdled within by these larvae and then a soft rot frequently completes the damage. The first signs of injury are usually noticed in June, in the wilting of a part or all of the plant during the heat of mid-day. In a few days the vines fail to recover at night and an examination reveals the presence of the yellow frass or "borings" on the ground at the base of the plant. The small hole cut by the borer gives a clue as to its location. The larvae are usually found within the stem near the opening. They vary in size according to age, but when mature range from one inch to an inch and a quarter in length; they are white in color with a small, brown head, which may be drawn in.

Winter is passed in the larval stage within a tough oval cocoon one or two inches under the ground. It is composed of silk spun by the caterpillar and interwoven with particles of soil which makes it almost indistinguishable. The caterpillar transforms into the pupal stage in

the spring and the moths emerge in May soon after the early squash plants are up. The dull, reddish-brown eggs are deposited singly on the stems, or cotyledons. The young caterpillars emerge from the eggs in about ten days and at once tunnel their way into the succulent stem. Here they feed for about four weeks until full grown, when they leave the stems, enter the soil and spin around themselves a tough oval cocoon. The second generation of moths appear in the late summer, producing another brood of borers which work on late squashes and pumpkins.

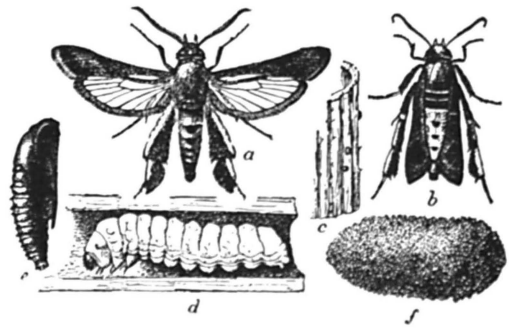

Fig. 8—The squash borer: (a), male moth; (b), female with wings folded at rest; (c), eggs shown on bit of stem; (d), full grown larva in vine; (e), pupa; (f), pupal cell. (After Chittenden.)

Control: The best method for control is to plant a trap crop, such as the Hubbard or crook-neck squashes, in a row extending cross the field to attract the moths. While not all of the eggs will be laid on these plants, the infestation of the regular crop may be materially reduced. Later, when most of the moths have laid their eggs, but before the first brood caterpillars have left the vines, the trap crop should be pulled and destroyed. When only a few plants are infested, the borer should be killed by making a longitudinal slit only half way thru the stem near the entrance hole. Soil should then be heaped over the mutilated vines and the plants watered plentifully until roots have developed from the buried stems.

Experiments conducted during three years in Massachusetts, have proved that nicotine sulfate is a good insecticide for killing the eggs of the squash vine borer. The nicotine sulfate was used at the rate of 1.3

Fig. 9—Pumpkins injured by squash vine borer.

fluid ounces per gallon of water (1 to 100) and was applied so that the bases of the plants were drenched on all sides. Four applications, one week apart in July, gave good control. It is probable that in Iowa, where this species is two brooded, that more applications would be necessary for good control.

THE STRIPED CUCUMBER BEETLE

(Diabrotica vittata Fabr.*)*

This is perhaps the most common cucurbit pest. (See fig. 1). The mature insect is a small, yellowish beetle about three-eighths of an inch long, with a black head and with three prominent, black stripes on the first pair of wings. The over-wintering adults appear in large numbers early in the spring and attack the young melon, cucumber, and squash plants just as they are beginning to break thru the surface of the soil. They feed greedily upon the tender young seedling leaves, sometimes gnaw around the base of the stems, and thus frequently destroy the young plants before they get a start. Later in the summer the beetles feed on the flowers as well as the leaves and may injure the cucumbers by eating thru the rind. After feeding for some time the females commence egg laying. The eggs are dropped in small openings and crevices in the soil near the stems of the plants or often simply dropped to the ground, wherever the beetle happens to be feeding. The eggs hatch in a week or a little longer and the young larvae, commonly called "worms," tunnel thru the base of the stems and roots, and the young plants gradually weaken and finally wilt and die. About 100 eggs are deposited by each female during her life time. After feeding for about a month the larvae reach maturity, form a small earthen cell near the surface of the ground and then transform within this cell into the pupal or resting stage. The adults issue in one or two weeks after pupation.

Control: *Gypsum-calcium arsenate dust.* A dusting mixture, composed of 20 parts of gypsum or land plaster and one part of calcium arsenate (Balduf formula) is a very effective control remedy in Iowa. This preparation acts as a repellant, a poison and to some extent perhaps as a fertilizer. The dust may be applied with the hands or by means of a shaker made by punching many small holes, with an 8-penny nail, in the bottom of a half gallon tin can. Most of the hand dusting machines are also effective. The first application should be made when the young seedlings are breaking thru the ground. Dust the plants two or three times a week, early in the morning when the dew is on, and immediately after a heavy rainfall, and apply the mixture liberally. From eight to twelve applications are necessary per season, depending upon weather conditions and the severity of the infestation.

Lead arsenate-gypsum dust. Lead arsenate may be substituted for the calcium arsenate, but should be used twice as strong—that is, one part to ten of the gypsum. Air slaked lime is sometimes substituted for gypsum, but is liable to scorch the leaves and does not adhere so well and, moreover, is not such an effective repellant as the gypsum. When the plants are in the two leaf stage, about one pound of dust will be needed for 30 to 35 hills. For each pound of poisoned gypsum dust used at this stage, 1.2 pounds will be needed when the plants are in the five to eight leaf stage, and two pounds when the vines are from three to four feet long.

Nicotine dust. When nicotine dust is used for controlling the striped cucumber beetle, a different formula from the above should be used, namely: nicotine sulfate, 1 part; monohydrated copper sulfate, 5 parts;

and hydrated lime, 14 parts, (Dudley formula). This preparation is superior to the plain nicotine sulfate—hydrated lime formula in combatting this beetle. The nicotine dust should contain at least two percent free nicotine and preferably four percent. The best time to dust is before the vines have started to run. At this time the beetles are congregated in large numbers in a comparatively small area. The effectiveness of the dust can be increased by using a canvas cone attached to the end of the spout of the duster. The cone is dropped quickly over the hill and several puffs given so as to fumigate thoroly all the area under the cone. The temperature should be at least 65° F. or higher for effective work and no wind should be stirring. Three applications at two-day intervals will kill the majority of the beetles and also the plant lice. However, the calcium or lead arsenate-gypsum dust is cheaper, easier to prepare and to handle, and moreover, is a very satisfactory remedy to use to control the striped cucumber beetle.

Fig. 10—The 12-spotted cucumber beetle.

OTHER CUCURBIT INSECTS

The adults of the southern corn root worm or 12-spotted cucumber beetle, *Diabrotica 12-punctata* Oliv. are general feeders and are frequently found on cucurbit plants. Its life history is quite similar to the striped cucumber beetle and the gypsum-calcium arsenate mixture will control this pest.

The tarnished plant bug *(Lygus praetensis* Fabr.), is frequently found on these vines, but is not of sufficient economic importance to be treated specifically here.

The squash lady beetle (*Epilachna borealis* Fabr.), feeds on cucurbs in various stages of its development. Hand picking or a poison dust will control this insect.

In 1922 and 1923, adults of the pickle worm *(Diaphania nitidalis* Cramer), were bred from wormy pickles collected in eastern and southeastern Iowa. Reports of injury are not numerous enough to consider the insect of much economic importance in the state, but in the gulf states it is a serious pest of all cucurbits, destroying the blossoms, tunneling the stems and frequently boring into the developing fruit. Infested blossoms and fruit of cucumbers, melons and squashes should be picked and destroyed.

PREPARING NICOTINE DUST

Nicotine dust is prepared by mixing nicotine sulfate and hydrated lime together in a tight container. The resulting product contains a certain percentage of free nicotine which is rapidly released as a gas upon exposure to the air. This gas, which is known as free nicotine, is very poisonous to many destructive insects, especially aphids or plant lice. Nicotine dusts, sometimes called nico dust, may be purchased from several commercial concerns, but can also be prepared at home.

HOW TO MAKE A MIXER

A dust mixer (fig. 1) may be purchased, but it can also be built at home. The materials needed are a good tight 50 gallon barrel, fifteen feet of 12x1-3/4″ boards and three feet of 2x4″ lumber, two pieces of pipe 1x6″, two one-inch pipe flanges, a door button and two leather straps for hinges. First cut an opening out of the side of the barrel

about 6x8″ in dimensions. Hinge the cut out portion as a door, pad the opening, and attach the door button in place. Next cut two pieces of lumber 12x36″ for the uprights and notch or bore a hole in one end of each large enough so that the iron piping will fit in loosely. Prepare a base for the uprights about 24x45″ and nail the uprights to each end of these, notch end upwards. Brace the uprights as shown in the figure, also using two pieces of pipe, thread each into the flanges and secure these into each end of the barrel. In this way an axle is formed upon which the barrel rotates. A handle for the mixer is then made and the apparatus is ready for use.

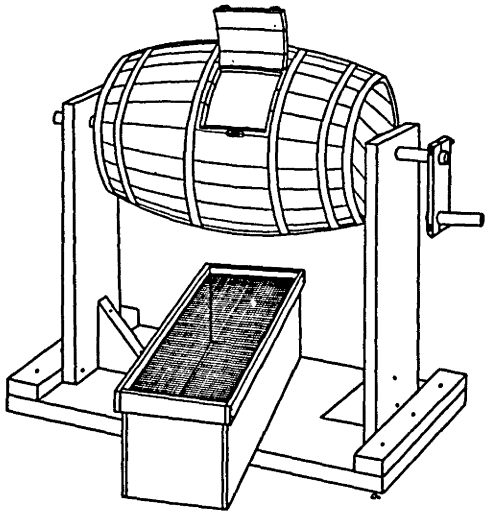

Fig. 11—Diagram showing construction of home made mixer for making nicotine dust.

To prepare 50 pounds of a one and one-half percent nicotine dust, which is the strength recommended for melon aphis, pour 50 pounds of hydrated lime in the barrel and add one and one-half pints or one and seven-eighths pounds of nicotine sulfate. About one-half a pound of small, round stones should be put into the barrel to facilitate mixing. Now close and fasten the door and then turn the barrel at a rate of about 35 revolutions per minute. At the end of exactly five minutes (use your watch) stop the mixing, open the door and pour the finished product into some handy container. A large dry goods box, over the top of which a coarse wire screen has been placed serves the purpose well. The screen catches the stones but allows the dust to pass thru. The finished product contains one and one-half percent nicotine and is ready for use at once. If not applied immediately, the dust should be poured into tight metal drums in order to prevent deterioration. Hydrated lime is an active carrier and nicotine dust soon loses its strength when exposed to the air.

The following table shows the correct proportions of the ingredients which should be used in preparing different strengths of nicotine dusts:

Strength of dust desired	Amt. nicotine sulphate	Amt. hydrated lime
1½ per cent (Free nicotine) or 3¾ per cent Nicotine sulfate	1⅞ lbs. or 1½ pints	50 lbs.
2 per cent (Free nicotine) of 5 per cent Nicotine sulfate	2½ lbs. or 2 pints	50 lbs.
3 per cent (Free nicotine) or 7½ per cent Nicotine sulfate	3¾ lbs. or 3 pints	50 lbs.
4 per cent (Free nicotine) of 10 per cent Nicotine sulfate	5 lbs. or 4 pints	50 lbs.